CLAIMS

What is claimed is:

1. An electrochemical cell component, comprising:

a plate having a first face and a second face;

at least one groove formed in the first face, the second face or a combination of the first and second faces, wherein the at least one groove has a nonuniform cross-section; and

an integral sealing member secured in the at least one groove, wherein the integral sealing member has a shape that cooperates with the nonuniform cross-section of the at least one groove to restrain removal of the sealing member.

2. The component of claim 1, wherein the integral sealing member is formed by injection molding into the at least one groove.

3. The component of claim 1, wherein the integral sealing member is an elastomer.

4. The component of claim 1, wherein the nonuniform cross-section of the at least one groove includes a via extending between a groove on the first face and a groove on the second face.

5. The component of claim 1, wherein the nonuniform cross-section of the at least one groove includes a plurality of vias extending between a groove on the first face and a groove on the second face.

6. The component of claim 1, wherein the nonuniform cross-section narrows at the surface of the plate.

7. The component of claim 1, wherein the at least one groove extends continuously around a perimeter of the faces.

8. The component of claim 1, wherein the at least one groove has a shape selected from circular, polygonal, irregular, and combinations thereof.

9. The component of claim 1, wherein the at least one groove follows a contiguous pattern over a face of the plate.

10. The component of claim 1, wherein the plate has a shape selected from circular, ovoid, oval and elliptical.

11. The component of claim 1, wherein the plate has a shape of a polygon.

12. The component of claim 1, wherein the plate is a frame, and further comprising:

at least one flow channel formed in the first face of the frame from a fluid inlet manifold to an inner edge of the frame;

at least one flow channel formed in the first face of the frame from the inner edge of the frame to a fluid outlet manifold.

13. The component of claim 12, wherein the at least one groove isolates each manifold from all other manifolds.

14 The component of claim 12, wherein the at least one groove encircles all manifolds formed through the faces of the plate except for the manifolds that are provided with the at least one flow channel.

15. The component of claim 12, wherein the at least one groove encircles all manifolds formed through the faces of the plate on the second face, and wherein the grooves encircle all manifolds formed through the faces of the plate on the first face except for the manifolds that are provided with the at least one flow channel.

16. The component of claim 1, wherein the plate is made of a metal or a polymer.

17. The component of claim 1, wherein the plate is made from a polymer selected from polyvinylidene fluoride, polyvinylidene difluoride, polytetrafluoroethylene, polyamides, polysulfone, polyetherketones, polycarbonate, polypropylene, polyimides, polyurethanes, epoxies, silicones, and combinations thereof.

18. The component of claim 1, wherein the plate is formed by injection molding.

19. The component of claim 1, wherein the plate is machined from a solid polymer sheet.

20. The component of claim 1, wherein the plate is a frame.

21. The component of claim 20, further comprising:

a flow field disposed within the frame.

22. A bipolar plate assembly, comprising:

a first and a second frame disposed on opposite sides of a gas barrier, wherein each of the first and second frames comprise first and second opposing faces, a first seal groove formed in the first face, a second seal groove formed in the second face, and a plurality of holes extending through the frame between the first groove and the second groove and an integral sealing member formed in the grooves and holes.

23. The bipolar plate of claim 22, wherein the first and second frames are bonded to the gas barrier.

24. The bipolar plate of claim 22, wherein the gas barrier is a metal sheet.

25. The bipolar plate of claim 22, wherein the integral sealing member is formed by injection molding.

26. The bipolar plate of claim 25, wherein the sealing member is an elastomer.

27. The bipolar plate of claim 22, wherein the seal grooves extend continuously around a perimeter of the faces.

28. The bipolar plate of claim 22, wherein each of the frames and the gas barrier have a shape selected from circular, ovoid, oval, polygonal and elliptical.

29. The bipolar plate of claim 22, further comprising:

at least one flow channel formed in the first face of the first frame from a first fluid inlet manifold to an inner edge of the first frame;

at least one flow channel formed in the first face of the first frame from the inner edge of the first frame to a first fluid outlet manifold;

at least one flow channel formed in the first face of the second frame from a second fluid inlet manifold to an inner edge of the second frame; and

at least one flow channel formed in the first face of the second frame from the inner edge of the second frame to a second fluid outlet manifold.

30. The bipolar plate of claim 29, wherein the seal grooves on each frame isolate each manifold from all other manifolds on each frame.

31. The bipolar plate of claim 29, wherein the grooves encircle all manifolds formed through the faces of each frame except for the manifolds that are provided with the at least one flow channel.

32. The bipolar plate of claim 29, wherein the grooves encircle all manifolds formed through the faces of each frame on the second face, and wherein the grooves encircle all

manifolds formed through the faces of each frame on the first face except for the manifolds that are provided with the at least one flow channel.

33. The bipolar plate of claim 22, wherein each of the frames is made of a polymer.

34. The bipolar plate of claim 33, wherein the polymer is selected from polyvinylidene fluoride, polyvinylidene difluoride, polytetrafluoroethylene, polyamides, polysulfone, polyetherketones, polycarbonate, polypropylene, polyimides, polyurethanes, epoxies, silicones, and combinations thereof.

35. The bipolar plate of claim 33, wherein at least one of the frames is formed by injection molding.

36. The bipolar plate of claim 33, wherein at least one of the frames is machined from a solid block of the polymer.

37. The bipolar plate of claim 22, characterized in that the integral seal is physically secured within the grooves.

38. The bipolar plate of claim 22, further comprising:

a flow field surrounded by one of the frames.

39. The bipolar plate of claim 38, wherein the flow field is made of a material selected from expanded metal mesh, metal felt, metal foam and combinations thereof.

40. A fluid cooled bipolar plate assembly, comprising:

a first, a second, and a third frame, wherein each of the frames comprise first and second opposing faces, a first seal groove formed in the first face, a second seal groove formed in the second face, and a plurality of holes extending through the frame

between the first groove and the second groove and an integral sealing member formed in the grooves and holes;

a first gas barrier and a second gas barrier, wherein the first gas barrier is disposed between the first and second frames and the second gas barrier is disposed between the second and third frames;

a cooling flow field, wherein the second frame surrounds the cooling flow field.

41. The fluid cooled bipolar plate of claim 40, wherein the first and second plates are bonded to the first gas barrier and the second and third plates are bonded to the second gas barrier.

42. The fluid cooled bipolar plate of claim 40, wherein the each of the gas barriers is a metal sheet.

43. The fluid cooled bipolar plate of claim 40, wherein the integral sealing member of each frame is formed by injection molding.

44. The fluid cooled bipolar plate of claim 40, further comprising:

at least one flow channel formed in the first face of the first frame from a first fluid inlet manifold to an inner edge of the first frame;

at least one flow channel formed in the first face of the first frame from the inner edge of the first frame to a first fluid outlet manifold;

at least one flow channel formed in the first face of the second frame from a second fluid inlet manifold to an inner edge of the second frame;

at least one flow channel formed in the first face of the second frame from the inner edge of the second frame to a second fluid outlet manifold;

at least one flow channel formed in the first face of the third frame from a third fluid inlet manifold to an inner edge of the third frame; and

at least one flow channel formed in the first face of the third frame from the inner edge of the third frame to a second fluid outlet manifold.

45. The fluid cooled bipolar plate of claim 44, wherein the seal grooves on each plate isolate each manifold from all other manifolds on each plate.

46. The fluid cooled bipolar plate of claim 40, characterized in that the sealing member is physically secured within the grooves.

47. The fluid cooled bipolar plate of claim 40, further comprising:

a flow field disposed within one of the frames.

48. The fluid cooled bipolar plate of claim 40, wherein the flow field is made of a material selected from expanded metal mesh, metal felt, metal foam and combinations thereof.

49. An electrochemical cell, comprising:

a frame having first and second opposing faces, a seal groove formed in the first face, a ridge formed on the second face, and a sealing member secured within the seal groove; and

a membrane compressed against the ridge to form a seal with the second face.

50. The cell of claim 49, wherein the membrane is a part of a membrane and electrode assembly.

51. The cell of claim 50, wherein the membrane is a proton exchange membrane.

52. The cell of claim 49, wherein the sealing member is selected from an o-ring and a gasket.

53. The cell of claim 49, wherein the sealing member is secured within the seal groove by injection molding.

54. The cell of claim 49, wherein the sealing member is an elastomer.

55. The cell of claim 49, wherein the seal groove extends continuously around a perimeter of the first face.

56. The cell of claim 49, wherein the ridge extends around the second face in a contiguous pattern.

57. The cell of claim 49, further comprising:

at least one flow channel formed in the first face of the plate from a fluid inlet manifold to an inner edge of the plate;

at least one flow channel formed in the first face of the plate from the inner edge of the plate to a fluid outlet manifold.

58. The cell of claim 57, wherein the seal groove isolates each manifold from all other manifolds.

59. The cell of claim 57, wherein the ridge isolates each manifold from all other manifolds.

60. The cell of claim 57, wherein the seal groove encircles all manifolds formed through the faces of the plate except for the manifolds that are provided with the at least one flow channel.

61. The cell of claim 57, wherein the ridge encircles all manifolds formed through the faces of the plate except for the manifolds that are provided with the at least one flow channel

62. The cell of claim 57, characterized in that the sealing member is physically secured within the groove.

63. The cell of claim 57, wherein the ridge is formed in the second face during manufacture of the plate.

64. The cell of claim 57, wherein the cell is compressed during assembly of an electrochemical cell, and wherein the ridge is formed by the sealing material being pushed against a floor of the seal groove to deform the second face with the ridge.

65. The cell of claim 57, wherein the plate is a frame.

66. The cell of claim 65, further comprising:
a flow field disposed within the frame.

67. The cell of claim 66, wherein the flow field is made of a material selected from expanded metal mesh, metal felt, metal foam and combinations thereof.